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INSTITUTE REPORT

ON

Instructional Materials Development in Science for Visually Handicapped

held at

American Printing House for the Blind
Louisville, Kentucky
March 19-21, 1970

Frank L. Franks, Coordinator
Educational Materials, Development and Research
Instructional Materials Reference Center

August 1, 1970

The purpose of the Science Institute was to examine areas in science where deficits in instructional materials are believed to exist, to identify specific aids necessary for teaching basic concepts in these areas, and to suggest priorities for development of relevant aids and materials.

Identification of materials deficits in science

Analysis of deficits in instructional materials focused on life science, earth science and physical science at the junior high level. Many of the materials at this level have implications for students above and below junior high high school, and consideration of the range of each instrument or aid was considered. Special attention was given to physics and chemistry.

Instructional materials needs were analyzed to:

1) Identify curriculum areas in science where greatest deficits for visually handicapped students were felt to occur.
2) Establish priorities in specific areas for in-depth examination.
3) Suggest priorities for initiating development of relevant aids and materials.

Discussion outline

Content units in the identified deficit areas were discussed. Basic concepts were examined. Discussion was guided by the following questions:

a. What is the purpose of the unit?

b. What concepts are taught?

c. What instruments or instructional materials are required to teach these concepts?

d. Are the instruments and materials available? Can they be developed, or adapted from existing materials?

e. Are there alternate techniques or methods for teaching these concepts which can be utilized to simplify the materials problem?

f. What suggestions do you have for overcoming or eliminating the deficit?

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PROGRAM OF INSTITUTE

Instructional Materials Development in Science for Visually Handicapped

American Printing House for the Blind
Louisville, Kentucky
March 19 - 21, 1970

Thursday

9:00 - 10:00	Welcome, Introductions, Purpose of the Institute
10:30 - 12:00	Life science
1:30 - 3:00	Life science--Summary
3:30 - 4:30	Earth science

Friday

8:30 - 10:00	Earth science--Summary
10:30 - 12:00	Physical science
1:30 - 3:00	Physics
3:30 - 4:30	Chemistry

Saturday

9:00 - 10:00	Physical science--Summary
10:30 - 12:00	Overall summary session

Tours of the Instructional Materials Reference Center and of the Science Materials Display area will be possible Thursday morning, 8 - 9 AM.

Alternative techniques

Alternative techniques for teaching laboratory science concepts to visually handicapped students were suggested where adequate materials are not available or the nature of the experiments does not permit the visually handicapped student to perform experiments by himself. Provisions include:

1) Reader service programs where a sighted student works with a visually handicapped student in the laboratory,

2) Provision for a team approach in the laboratory where the visually handicapped student is a member of a team or group,

3) Volunteer workers composed of college students who come in and work with the regular teacher, thus reducing the pupil-teacher ratio in laboratory sessions.

DEFICIT AREAS

Deficits in life science, earth science and physical science are reported below.

Life Science

1) Light probe. Various experiments using the light probe were discussed. Among these were: (Example given with a.)

a) Displacement of chlorophyll.

(1) Leaf in alcohol - clear liquid - high pitched sound from probe.

(2) After chlorophyll makes liquid green - lower pitched sound from the probe.

b) Measuring levels of liquids.

c) Determination of chemical change.

d) Acid-base experiments.

e) Color discrimination experiments using a prism.

f) Chemical changes.

Utilization of the light probe appears to offer new opportunities for laboratory experiences to blind students in life science, earth science and physical science. The group endorsed the light probe and recommends investigation of its possible uses in laboratory science. These findings should be made available to teachers in the field.

Since the light probe is not available in this country, investigation should be made to determine the possibility of a light probe being made available on quota.

This aid should be given high priority.

2) Tactual tape measure. Light weight tactual tapes, marked in centimeters and in inches, are needed for such experiments as:

a) Teaching rate of growth of plants

b) Measurement of objects which require a flexible tape for reaching around or through the objects.

3) Anatomical models--human and animal. There are many good models available from commercial distributors. Further investigation should be made to identify those best suited for visually handicapped students, and to identify those that require minimum adaptation. High priority was given to the following:

a) Human torso. A human torso should be adapted in some

way to enable school programs to get it on quota.

b) Pull-apart cell. A simple, pull-apart cell is needed.

Alternatives

Pleasant, smooth, plastic - rubber material for single cell either plant or animal. Nucleous should be removable. In animal cells, genes and chromosones should be identifiable and if possible could be pulled apart from the nucleous. The whole mitosis series of individual changes in cell division should be included in a kit of these pull apart cells.

The same concepts above could be tried out with a cell containing a jelly-like substance indicating the nature of protoplasm. Harder and more consistent plastic could be used for the nucleus.

Suggestions and Recommendations--Anatomical Models.

1) Evaluate existing biological models in terms of the needs of visually handicapped students. Many available models are excellent but are too visually oriented.

2) Flexible models are better than plastic. Make models as realistic as possible, tactually. Investigate the use of textured surfaces to differentiate various parts indicated on the model.

3) A material and/or process for labeling parts and identifying items on models other than dymotape is needed.

4) Accompanying manuals need to be edited with the (grade) levels of students using them kept in mind.

5) In elementary school, some larger-than-life models are needed.

These include:

a) Pull-apart cells

b) Protozoa and amoeba

c) Mitosis (Each stage should be pull-apart.)

6) Make as many models as possible pull-apart for tactual inspection.

7) Include scale of modification when the size is not actual or life size.

8) Make provision for purchase on quota of as many of these models as possible.

Three-Dimensional Models.

Sets of models on thermoform should be developed. These will be inexpensive and can supplement live animals and models (grasshoppers, fish) used in teaching life science.

1) Animal Set. A model representative of each phylum of invertebrates should be included in a set of materials.

2) Plant Set. Representative models of plants should be prepared for use with visually handicapped students.

3) Other. Investigation should be made to determine the development and adaptation of a variety of sets of 3-D models. These may include:

a) Bacteria

b) Planeria

c) Other

Suggestions and Recommendations--Three Dimensional Models.

1) Keep detail simple.

2) Utilize different textures, where feasible, for different body parts to increase contrast.

3) Emphasize tactually, the body area that is most important or the part that is stressed in the print diagram or model.

Earth Science

1) Weather Kit. Emphasis was placed on the development of a weather kit which might include:

a) Weather map

b) Weather station

c) Weather vane

d) Hygrometer to measure humidity

e) Barometer (aneroid)

f) Include a humidity table

g) Wind sock

2) Water Chemistry Kit (Oceanography). With applied chemistry becoming more emphasized in science instruction in such areas as water pollution, there is an increasing need for materials to provide laboratory-type experiences for visually handicapped students in water chemistry and oceanography. Usefulness of the light probe in water chemistry experiments performed by blind students. Curriculum analysis in this area should be made to ascertain current needs of aids and materials for visually handicapped students.

3) Space science. Many materials are available commercially for sighted students. Some require adaptation. There is a need for a suspension-type solar system model for blind students. Some teacher-made models involve materials presented with an umbrella effect. More models which move are needed.

4) Electrolysis. No kit is needed, but a light probe which can be used to perform a number of experiments is not available in this country.

5) Geology. Available geology materials should be evaluated in terms of needs of visually handicapped students. (A number of good materials for sighted are available.) Some 3-D tactual models are needed to teach rock layers, earth cross-sections, etc. These could be produced in thermoform at a low cost.

6) Mineral and other collections in the form of identification kits are already available. These should be examined, and the sources of the better kits should be compiled.

Physical Science

Chemistry. More than one dozen blind students throughout the US are in Chemistry programs in colleges. In the future more visually handicapped students can become involved in chemistry. Chemistry as a high school laboratory science course should be analyzed to determine instructional aids needed by visually handicapped students. This should be done in cooperation with Chemistry classes which are being taught for

blind students in residential programs and with individual visually handicapped students enrolled in sighted classes in public school programs.

Immediate needs which are recognized include:

1) Chemistry Laboratory Measurement Equipment. Development of burets, graduated cylinders and beakers adapted for use by blind students should be given high priority.

2) Atomic Wall Chart of Periodic Table. There is great need for this table. Perhaps it can be made in folding sections. A Radical Chart is also needed.

3) Collection of Experiments. A collection of experiments which have been successfully performed by blind students, not eliminating those with sighted interpretations, should be begun immediately. These should be bound in a loose-leaf binder which will allow for inclusion of additional experiments. Each experiment should compose a unit and should begin on a separate page.

4) Protective Devices for Partially Seeing Students. Devices which will allow partially seeing students to get closer to experiments should be developed.

Physical Science

1) Electrical Measurement. To complement the Measurement in Science Kit, aids in electrical measurement should be developed. These might include:

a) Galvanometer

b) Light meter

c) Volt meter

d) Ohm meter

2) Magnetism. Existing materials in this area should be examined with a view toward adaptation of the better aids. There is need for an electronic compass (with built in light source) which can be used by blind students. The geiger counter should be examined also as a possible aid for visually handicapped students. (The SCIS group, California, is preparing a kit in electricity and magnetism.)

3) Thermometer. A general purpose thermometer is needed for use in simple science experiments. This instrument should have points of emphasis (freezing point, boiling point, room temperature) labeled in braille and large print.

4) Light. A tactual model, perhaps made of strings, wires and folds, etc., is needed to demonstrate the change in focal point of light rays.

5) Electronics. A code oscillator (for ham operators) is needed. A number are available commercially.

6) Heat (Fire, Convention, Radiation, Gases). A Davey-lamp-type of aid is needed to demonstrate gas explosion, kindling point, heating of gases, etc.

7) Sound. Examine existing units and kits in sound, select the best and adapt for visually handicapped students. Make available on quota.

8) Model of an atom. A model of an atom should be developed for visually handicapped students. It should be more tactually oriented than those available commercially.

9) Compass. A compass with a built in light source for finding direction at night is needed.

Priority list

High priority was given to the following areas and specific items.

Life science

1) Anatomical models
   a) Human torso
   b) Pull-apart cell
   c) Other anatomical models which should be adapted for visually handicapped students

2) Three-dimensional models
   a) Animal set (invertebrates)
   b) Plant set
   c) Bacteria, planeria, etc.

Earth science

1) Weather kit
2) Water chemistry kit
3) Three-dimensional models in geology (Earth cross-section, etc.)

Physical science

1) Chemistry materials

a) Collection of experiments actually performed by blind students (AEVH?)

b) Chemistry laboratory measurement equipment

c) Atomic wall chart of periodic table

d) Protective devices for partially seeing students

2) Electrical measurement materials

3) Sound kit

4) Model of an atom (pull-apart)

Individual items identified

1) Light probe

2) Tactual tape

3) Davey lamp

Recommendations

1) Existing instructional materials, kits and individual aids in science available from commercial distributors should be evaluated to determine their usefulness for blind and partially seeing students. The best representative of each kind of model should be considered for adaptation if it has instructional value for visually handicapped students.

2) The IMRC should alert central catalog users to materials available in science which have proven useful to visually handicapped

students, without adaptation. These materials should be evaluated by educators or specialists who have used the aids or have seen them in use in educational programs.

3) The IMRC should distribute information to the field to encourage the feasibility of visually handicapped students studying science.

4) Materials should be developed that get young visually handicapped students involved in science in the elementary grades. Simplified models with a minimum of detail should be made available.

5) The IMRC should become involved in the testing and production of SCIC materials in cooperation with the Lawrence Hall of Science (University of California). Many of these adaptations are to introduce the young visually handicapped student to basic science concepts.

6) Instructional procedures for using instruments and aids developed and/or adapted should be provided on an elementary level in braille and in large print.

7) Teachers' manuals for the above should be prepared where possible.

8) Appropriate IMRC personnel should be available to demonstrate at regional centers and meetings and at special conferences tangible apparatus and equipment developed for visually handicapped students. Emphasis would be on demonstration as opposed to display of materials.

9) Participants expressed concern and interest in education of visually handicapped students in public school and residential school settings, and recognize that visually handicapped students in public school programs integrated in sighted classes may have particular problems in science instruction which should be considered in the development, testing and evaluation of instructional materials.

10) Investigations in other academic areas similar to this Institute should be considered.

11) Reports of this Institute should be made available to members of the Mathematics Institute.

12) Relevant information from this and other Institutes should be made available to educators in the field.

13) Participants in the Science Institute agree to cooperate in so far as possible in the realization and implementation of the recommendations made herein.